OUR BOOK SHELF

Theorie der algebraischen Gleichungen. Von Dr. Jul. Petersen. xii. and 335 pp. (Kopenhagen, 1878.)

THE author tells us that this work owes its origin to the lectures he has given on the theory of equations at the Copenhagen Polytechnic School. In the preparation of it he has made use of J. A. Serrêt's "Cours d'Algèbre Supérieure," Todhunter's "Theory of Equations," and Jordan's "Traité des Substitutions." The first section treats of equations in general; Cap. I. general properties of algebraic equations; Cap. II. relations between the coefficients and roots; Cap. III. on elimination, describing the methods of Labatie, of Euler, of Sylvester, of Bezout, and of Poisson; Cap. IV. the transformation of equations. The second section is devoted to the algebraic solution of equations, viz., of the cubic (the methods of Hudde, Lagrange, Tschirnhausen, and Euler); of the biquadratic (the methods of Lagrange, Descartes, and others); the binomial equation, the Quintic, the breaking-up of a rational polynomial into rational factors, Abelian equations (a long chapter, including the division of a circumference into seventeen equal parts, and the reduction of the equation $x^{13} = 1$).

The third section is on the Numerical Solution of Equations: Cap. I., on the Separation of Roots (Descartes', Budan's, Rolle's, Sturm's, and Newton's theorems); Cap. II., the Calculation of the Roots in Numerical Equations (interpolation, of Newton's Method of approximation, also Lagrange's and Horner's methods). The fourth part, which treats of Substitution in four chapters: Cap. I. Substitution in General; Cap. II. (a long chapter, including the theorems of Lagrange and Cauchy, alternate, transitive, and intransitive groups, linear substitutions, &c.); Cap. III. Galois' Theory (this has not found its way into English text-books; Prof. H. J. S. Smith classes Galois, for early precocity, with Pascal and Gauss); Cap. IV. Applications of Galois' Theory (Abelian equations, the Galois and the Hessian equations).

This bare enumeration of the principal articles will show that this carefully-written treatise takes up some ground which has not yet been opened out or even alluded to in our common text-books on equations.

The Botany of Three Historical Records, Pharaoh's Dream, The Sower, and the King's Measure. By A. Stephen Wilson. (Edinburgh: David Douglas, 1878.)

THIS is a curious little book, the author's aim being to throw what light he can, either by comparison or suggestion, upon the probability of the plants referred to in these Scripture records being this or that species of cereal. Mr. Wilson seems to have given a good deal of consideration to each of the above questions, which, as he says in his preface, have only one bond of connection between them, namely, "a common basis in the botany of the cereal grasses." Notwithstanding the pains the author has evidently given to each of the subjects, we cannot but think that it will prove of but little value, the points advanced being by no means conclusive, and even the subjects in themselves being of small importance. It may be of some value to know whether the cereals "stand in the same alimentary relationship to mankind as they did when Joseph laid up the surplus of the plenteous years in the granaries of Egypt," because such a knowledge, if it could be proved, would show the progress made in developing the productive resources of these grasses, but whether the plant in Pharaoh's dream was *Triticum compositum*, or any other species of *Triticum*, is perhaps of little moment to mankind at the present time. As an illustraiton of what is to our mind mere speculation, we quote the following from p. 6:—"The wheats of 'Minnith,' in the Belka (Ezek. xxvii.) grown by the farmers of Judah and Israel, seem to have been in demand in the corn-market of Tyre. Probably Minnith was a remarkably good locality for wheat, so that when the husbandman in other districts got seed from this place they called it Minnith wheat."

The author's summing-up of this his first "Historical Record," namely, that "seven ears of corn came up upon one stalk," is that it "may be wrong, and probably is wrong, whereas the reading here proposed, that seven ears of corn came up upon one *stock*, while probably expressing the full meaning, can only err by defect, and must necessarily be right, as embracing an essential morphological fact common to all varieties of corn."

The Commercial Products of the Sea; or, Marine Contributions to Food, Industry, and Art. By P. L. Simmonds. With thirty-two illustrations. (London: Griffith and Farran, 1879.)

THIS is the first example this year we have had of a work antedated, in this case by more than two months. We cannot possibly see what is gained by this; is it meant to make readers of future years believe that a work was published a year later than it really was? If this is so, is it quite honest and respectable—to put it in the mildest possible form? When one gets over Mr. Simmond's extraordinary and often misleading style (for which we commit him to the tender mercies of the literary Dr. Birch), it is found that his work contains a great mass of useful and curious information, showing great diligence in the collection of facts, if not much skill in putting them together. Mr. Simmonds' work is divided into three parts, dealing with food-products obtained from the sea, marine contributions to industry, and marine contributions to art. Detailed accounts and statistics are given of the various fisheries of the world, under the first head; under the second head the sponge fisheries are dealt with, oils, isinglass, shells, seaweed, marine salt, and other products; and under part iii. tortoise-shell, mother-of-pearl, coral, and amber. It will thus be seen that the work has a wide range; it shows how much has been done, and how much yet remains to be done by science, to make the most of the products with which the waters swarm. Altogether the work contains much useful and interesting information in a handy form.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

A Question raised by the observed Absence of an Atmosphere in the Moon

IT is known that there is physical evidence of an absence of atmosphere in the moon. It would appear reasonable to conclude that the moon at one time had an atmosphere; for, according to the generally-accepted principles of Laplace, which make the sun and members of the solar system to have a common nebulous origin, it would seem very extraordinary if the particular offshoot of the common nebula which formed the moon had no gaseous constituent in it. If we admit, therefore, as probable that the moon at one time had an atmosphere, the question naturally suggests itself as to what has become of it. Various surmises have been hazarded in reply to this. I would venture to submit the following as a possible explanation, which, as far as it goes, is based on accepted principles:—It is known to be a demonstrated fact in connection with the established kinetic theory of gases that the velocities of the molecules of a gas vary among themselves from zero to an *indefinitely* great

velocity, *i.e.*, a velocity to which apparently no limits can be set. It is true that the molecules which in the accidents of collision among themselves acquire these enormous velocities, have been mathematically proved to be relatively few in number, the greater number of the molecules possessing velocities approaching the mean value. But it would seem to follow necessarily that molecules situated in the top stratum of any atmosphere, and which acquire these enormous (indeterminable) velocities, can sometimes overcome gravity, and be projected into space, so as not to return; as it is a known fact that only a *finite* velocity is required to effect this result. I have therefore to suggest that by this cause the moon's atmosphere has gradually disappeared. It is probable, no doubt, that it would take a vast period of time to have brought about this result, but we have an almost unlimited time at disposal. It might possibly be asked, How is it that the earth's atmosphere has not shared the same fate? In answer to this I would reply, first, that the value of gravity on the earth is known to be very much greater than on the moon, and second, that possibly (for aught we can tell) part of the earth's atmosphere may have thus disappeared; or the earth's atmosphere may be less dense at present than at one time, for anything we can say to the contrary. It would seem a curious fact to note in connection with this that there would be apparently grounds for inferring that the *constitution* or composition of the earth's (or any other planet's) atmosphere might have changed from the above cause, as evidently the lighter gaseous constituents, whose molecules acquire in the accidents of collision the highest velocities, would be first dissipated into space in the above manner. Thus, for example, any trace of that very prevalent constituent of the universe, hydrogen, that might have at one time existed in the earth's atmosphere, would have tended to become relatively rapidly eliminated, as the molecules of hydrogen are known to possess a normal velocity about four times as great as that of the constituent molecules of the earth's atmosphere.[1] It might be said that changes so great as those above indicated are scarcely realisable, but then it should be kept in view that we have an almost limitless range of time to draw on, and it is generally admitted to be very important to take the effect of time into due consideration, as, for example, is done in the case of geology, where mountain ranges are recognised by incontrovertible physical proof to have been carved out by the slow disintegrating action of rain and atmospheric influences prevailing through countless centuries. The gradual disappearance of an atmosphere (earth's or moon's) under the above cause might possibly be compared in slowness of operation to the other cosmical changes that the solar system is known to be undergoing, such as the gradual approach of the earth to the sun (and of the moon to the earth) through the friction of the material media in space, the accomplished stoppage of the moon's axial rotation by tidal action on its mass, and the gradual diminution of the earth's rotative velocity from the same cause. These slow changes, imperceptible in the range of human experience, become important in large time epochs, and it becomes desirable in the interests of truth, in tracing back events, to give due weight to these time epochs. In suggesting the above explanation, I have endeavoured to confine myself strictly within the limits of mathematically proved facts as a basis to draw deductions upon, and I should be glad to accept any criticisms that might be offered, either with the view to point out a difficulty or confirm the truth.

London, October S. TOLVER PRESTON

[1] The realisation of a possible diversity at a former epoch in the constitution and density of the earth's atmosphere raises rather a curious question in connection with the known diversity of the plants and animals that formerly inhabited the globe, as compared with those at present existing. It might be observed that admitting the possibility of the former existence of an atmosphere on the moon, it would seem to follow that an interchange of molecules between the two atmospheres (those of the earth and moon) must have taken place at one time to a certain extent under the above cause, though the considerably less value of gravity on the moon compared with the case of the earth would facilitate the passage of molecules away from the moon and render correspondingly difficult the passage in the reverse direction.

Remarkable Local Colour-variation in Lizards

THE following extract from a letter received some months since from Baron de Basterot, of Rome (a Fellow of the Geological Society of London), records an interesting case of local colour-variation, about which some of your correspondents may be able to give us further information :—

"Capri is a mass of the usual yellowish-white Apennine limestone, forming precipitous cliffs nearly all round the island. At its southern extremity are three high and nearly inaccessible rocks called I Faraglioni, one of which, pierced by a natural arch, has been frequently depicted by artists. Two of these rocks are completely detached from the mainland, and, I need hardly add, uninhabited.

"On the island, and on the first of the Faraglioni rocks which is connected with it, the lizards are of the usual species so common in Italy—coloured grey, mixed with more or less green. On the two outward Faraglioni rocks, which are completely separated from the shore, their colour is totally different. The back is of a blue so dark as to appear nearly black; the sides of a brilliant blue, like lapis-lazuli; the belly light whitish-blue, with a very slight tinge of green.

"An English gentleman whom I met in Capri had several of these lizards alive, which had become quite tame in the course of a couple of months. I believe he intends bringing them to England. He is of opinion that they differ in colour only from the lizards of the island, and that, though very different in appearance, they are the same species.

"Whether this be so, or whether they are specifically different, their presence on these isolated rocks and their total absence on the island is equally remarkable."

ALFRED R. WALLACE

Termites kept in Captivity by Ants

WHEN entomologising in Portugal in 1877, in the neighbourhood of Cintra, I found the nest of *Formica nigra* under a stone. On my turning it over there was, as usual, great consternation in the community, and I discovered that it was evidently caused by the fear lest a colony of *Termes lucifugus*, which the Formicas had enslaved, should escape. The Nigras instantly began seizing the Termites, driving them underground by the nearest orifices, in the meantime wrenching and pulling off their wings in the most unceremonious manner. I observed a large number of wings lying in heaps here and there in the nest as if this treatment had been practised before. In the nest there was also a great number of Termite larvæ. The great object of the owners of the "location" seemed to be to get these larvæ underground as speedily as possible. The ants fell on them with great impetuosity, seizing them anyhow and anywhere, dragging them against the most strenuous opposition (their behaviour strikingly contrasting with the meekness of their winged fellows) into the nearest apertures of the underground home. Very often this opposition resulted in a long and stern fight, in which the larvæ were often badly wounded, being deprived sometimes of their antennæ, sometimes of half their jaws, and not seldom killed outright. Occasionally, however, the larvæ were victorious, beating off the Formicas, in which case they (the larvæ) did not make off, but remained perambulating the nest. I saw one larva drawn at the end of a long fight by its antenna, while it strenuously held on to a small ball of earth which had proved a vain anchorage for its feet, for larva and clod together were dragged across the top of the nest (made by the impression of the stone) five or six inches, up the side, 1½ inch, and away among the grass, where, losing the ball of earth, it seized a stalk so firmly that its abductor could not drag it farther, whereupon, after reconnoitring the ground for a little distance the latter disappeared, but returned shortly with a companion, with whose aid the larva was detached. This done, the helper returned home while the abductor proceeded with his prisoner till lost to view in the grass, some twelve or fourteen inches from the spot whence it originally started.

In the same neighbourhood I watched for some time a nest of *Formica ligniperda*. An injured female was placed in the nest, but no assistance was rendered, while it crawled along towards the nearest orifice leading underground. At the spot where this individual was injured some of the fluid of its body which had oozed out was eagerly lapped up by the others; some even applied their mouths to the wounds on the body. During the operation of lapping the maxillæ were kept perfectly still, and the antennæ close to the side of the head "feel-feeling" the ground with the tips, as if to discover the spot where the liquid was to be found. Every now and then, however, they were extended at right angles to the body, as if to obtain a more general survey of things, and then immediately returned to their previous position. On several of those which were busy lapping I poured some spirits of wine. They instantly became stupefied, and for a time motionless. When in this condition they were